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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/617,548	07/10/2003	Michael John Bowman	134195	4282
6147	7590	08/30/2006	EXAMINER	
GENERAL ELECTRIC COMPANY GLOBAL RESEARCH PATENT DOCKET RM. BLDG. K1-4A59 NISKAYUNA, NY 12309			VANOY, TIMOTHY C	
			ART UNIT	PAPER NUMBER
			1754	

DATE MAILED: 08/30/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/617,548

Applicant(s)

BOWMAN ET AL.

Examiner

Timothy C. Vanoy

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 August 2006 and 09 May 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19, 21 and 22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 2, 3 and 10-19 is/are allowed.
- 6) ☒ Claim(s) 1, 4-9, 21 and 22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on Aug. 17, 2006 has been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

The person having ordinary skill in the art has the capability of understanding the scientific and engineering principles applicable to the claimed invention. The references of record in this application reasonably reflect this level of skill.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 4, 8, 9 and 21 are again rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent 6,793,910 B1 to Lyons et al.

Claim 1 in Lyons et al. reports a method and the patent discloses an apparatus for producing synthesis gas (i. e. a hydrogen containing gas: please also see col. 2 lns. 54-56), by:

Introducing steam and hydrocarbon into a rotary-type compression reactor (please also see fig. 1);

Compressing the steam and the hydrocarbon;

Raising the temperature of the steam and hydrocarbon;

Spark-igniting the steam and hydrocarbon to produce a synthesis gas;

Expanding the synthesis gas, and

Exhausting the synthesis gas product out of the compression reactor.

Note that col. 3 line 66 to col. 4 line 2 in the Lyons et al. patent reports that the compression reformer may require the addition of mechanical power, in a manner rendering obvious the limitations of applicants' claim 4.

The difference between the applicants' claims and the Lyons et al. patent is that the applicants' independent claims call for the production of hydrogen without any combustion, whereas the Lyons et al. process conduct the reformation with what appears to be some minimal amount of combustion: please see col. 3 lns. 29-35 in the Lyons et al. patent.

The Lyons et al. patent reports that the amount of oxygen that is fed into the reactor is limited so that oxygen mass balance inhibits the combustion reactions: please see col. 3 lns. 29-35. Also, the chart 1 in col. 3 in the Lyons et al. patent reports that (unwanted) water is a product of the combustion reaction (not the desired hydrogen).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus described in the Lyons et al. patent by operating the reforming reactions without combustion, in the manner required in the applicants' independent claims, because col. 3 lines 29-35 in the Lyons et al. patent fairly suggests that the combustion reactions should be inhibited, and in so doing one would convert the hydrogen values into wanted hydrogen gas rather than unwanted water.

The difference between the applicants' claims and the Lyons et al. patent is that the applicants' claims 8 and 21 call for preheating the hydrogen-containing gas (prior to injection into the compression reactor) or introducing auxiliary heat into the compression

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chamber by using the heat from by-product conversion into exhaust product or from the heat generated from an internal combustion engine, however it is submitted that these differences would have been obvious to one of ordinary skill in the art at the time the invention was made because the Lyons et al. patent expressly teaches that the reformation reaction occur at elevated temperatures (a temperature of 1,073 °K is mentioned in Example 1 and a temperature of 1,273 °K is mentioned in Example 2 in the Lyons et al. patent) and pre-heating the feed gas and/or transferring heat to the compression chamber (in the manner required in applicants' claims 8 and 21) is an obvious means for more quickly attaining the elevated reaction temperatures used in the reformation processes described in the Lyons et al. patent. Note that the rationale to modify a reference does not have to be expressly stated in the prior art; the rationale may be impliedly contained in the prior art or it may be reasoned from knowledge generally available to one of ordinary skill in the art: please see the discussion of the *In re Fine* 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) court decision set forth in section 2144 in the MPEP (Rev. 3, Aug. 2005).

Claims 1 and 4-9, 21 and 22 rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent 6,793,910 B1 to Lyons et al. as applied to claims 1, 4, 8, 9 and 21 above, and further in view of U. S. Patent 6,066,307 to Keskar et al.

Claim 1 in Lyons et al. reports a method and the patent discloses an apparatus for producing synthesis gas (i. e. a hydrogen containing gas: please also see col. 2 lns. 54-56), by:

Introducing steam and hydrocarbon into a rotary-type compression reactor
(please also see fig. 1);

Compressing the steam and the hydrocarbon;

Raising the temperature of the steam and hydrocarbon;

Spark-igniting the steam and hydrocarbon to produce a synthesis gas;

Expanding the synthesis gas, and

Exhausting the synthesis gas product out of the compression reactor.

Note that col. 3 line 66 to col. 4 line 2 in the Lyons et al. patent reports that the compression reformer may require the addition of mechanical power, in a manner rendering obvious the limitations of applicants' claim 4.

The difference between the applicants' claims and the Lyons et al. patent is that the applicants' independent claims call for the production of hydrogen without any combustion, whereas the Lyons et al. process conduct the reformation with what appears to be some minimal amount of combustion: please see col. 3 lns. 29-35 in the Lyons et al. patent.

The Lyons et al. patent reports that the amount of oxygen that is fed into the reactor is limited so that oxygen mass balance inhibits the combustion reactions: please see col. 3 lns. 29-35. Also, the chart 1 in col. 3 in the Lyons et al. patent reports that (unwanted) water is a product of the combustion reaction (not the desired hydrogen).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus described in the Lyons et al. patent by operating the reforming reactions without combustion, in the manner required

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in the applicants' independent claims, because col. 3 lines 29-35 in the Lyons et al. patent fairly suggests that the combustion reactions should be inhibited, and in so doing one would convert the hydrogen values into wanted hydrogen gas rather than unwanted water.

The difference between the applicants' claims and the Lyons et al. patent is that the applicants' claims 8 and 21 call for preheating the hydrogen-containing gas (prior to injection into the compression reactor) or introducing auxiliary heat into the compression chamber by using the heat from by-product conversion into exhaust product or from the heat generated from an internal combustion engine, however it is submitted that these differences would have been obvious to one of ordinary skill in the art at the time the invention was made because the Lyons et al. patent expressly teaches that the reformation reaction occur at elevated temperatures (a temperature of 1,073 °K is mentioned in Example 1 and a temperature of 1,273 °K is mentioned in Example 2 in the Lyons et al. patent) and pre-heating the feed gas and/or transferring heat to the compression chamber (in the manner required in applicants' claims 8 and 21) is an obvious means for more quickly attaining the elevated reaction temperatures used in the reformation processes described in the Lyons et al. patent. Note that the rationale to modify a reference does not have to be expressly stated in the prior art; the rationale may be impliedly contained in the prior art or it may be reasoned from knowledge generally available to one of ordinary skill in the art: please see the discussion of the *In re Fine* 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) court decision set forth in section 2144 in the MPEP (Rev. 3, Aug. 2005).

The difference between the applicants' claims and the Lyons et al. patent is that applicants' claims 5-7 and 22 call for the step of separating the hydrogen-containing product from the reformation into a hydrogen-rich product and a by-products rich product (for example, by a membrane separator: please see applicants' claim 6).

U. S. Patent 6,066,307 to Keskar et al. describes a process for producing synthesis gas which includes the step of passing the synthesis gas product through a hydrogen transport membrane to produce a hydrogen-rich product and a by-products-rich product: please see the abstract and also col. 4 lines 45-50 in U. S. Patent 6,066,307.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of the Lyons et al. patent by subjecting the product synthesis gas to a hydrogen separation membrane, as disclosed in col. 4 lines 45-50 and the abstract of U. S. Patent 6,066,307 and required in applicants' claims 5-7 and 22, because of the expected advantage of obtaining highly pure hydrogen product – the desired product of the applicants' claims and the Lyons et al. patent: please see col. 1 lines 16-20 in the Lyons et al. patent.

Claims 2 and 3 have not been rejected under either 35USC102 or 35USC103 because there is no teaching or suggestion in U. S. Patent 6,793,910 B1 to modify the compression reactor to include a second entry port for receiving steam in the manner required by applicants' claims 2 and 3.

Claims 10-19 have not been rejected under either 35USC102 or 35USC103 because there is no teaching or suggestion in U. S. Patent 6,793,910 B1 to conduct the reformation reactions in the absence of combustion. The process of U. S. Patent 6,793,910 B1 requires the reactions to occur in the presence of combustion: please see col. 3 lines 29-37 in U. S. Patent 6,793,910 B1.

Response to Arguments

Applicant's arguments submitted with the amendment filed on Feb. 14, 2006 have been fully considered but they are not persuasive.

a) *The applicants argue that the process described in claims 1, 10 and 21 does not involve any combustion step, which is necessary for the process described in Lyons (U. S. Patent 6,793,910). In Lyons, the combustion step (even if in a limited manner) is essential to the success of the process described by Lyons. Lyons does not suggest any improvement/modification or operation of the reforming system by totally eliminating the combustion step. As the process described by Lyons is adiabatic, the limited combustion is expected to play a very important role in the entire reforming process since the steam/methane reforming reaction is endothermic.*

The applicants' arguments have been found persuasive as far as the process claims 10-19 are concerned, but the rejection of the system claims 1, 4-9, 21 and 22 is maintained because the argued intended use of the apparatus (to conduct the reformation without any combustion) does not further limit the system per se. The system appears to be at least obvious from Lyons (U. S. Patent 6,793,910 B1)

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regardless of whether or not any combustion is occurring in the reaction chamber.

Since no distinction is seen or has been shown between the systems, per se, the rejections are maintained over the applicants' system claims.

Applicant's arguments submitted with their 116 response filed on May 9, 2006 have been fully considered but they are not persuasive.

a) *The applicants argue that U. S. Patent 6,793,910 to Lyons discloses an apparatus for producing synthesis gas using air, steam and hydrocarbons. The reforming reactions involved in the process include combustion reactions and steam reforming reactions. In contrary, applicants' claims 1 and 21 recite a system for producing hydrogen in a reforming reaction that does not involve any combustion. Although Lyons reports that the amount of oxygen which is fed to the reactor is limited so that the oxygen mass balance inhibits the combustion reactions, the combustion reactions (even if in a limited manner) is essential for the success of the process described in Lyons.*

The applicants' arguments have been found persuasive as far as the process claims 10-19 are concerned, but the rejection of the system claims 1, 4-9, 21 and 22 is maintained because the argued intended use of the apparatus (to conduct the reformation without any combustion) does not further limit the system per se. The system appears to be at least obvious from Lyons (U. S. Patent 6,793,910 B1) regardless of whether or not any combustion is occurring in the reaction chamber.

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Since no distinction is seen or has been shown between the systems, per se, the rejections are maintained over the applicants' system claims.

b) *The applicants argue that the Lyons apparatus requires a spark plug (Figs. 1-14 in Lyons) for starting the combustion reaction. However the applicants' apparatus does not require a spark plug because the applicants' reforming reactions are completely devoid of any combustion reaction.*

There is nothing in the applicants' apparatus claims that materially exclude the presence of a spark plug.

c) *The applicants argue that the process described by Lyons is adiabatic (no heat supplied from the outside) and the limited combustion described in Lyons is expected to play a very important role in the entire reforming process because the steam reforming reaction is endothermic.*

The argument is not accompanied with any evidence that the claimed apparatus is unobviously distinct from the apparatus disclosed in the Lyons et al. patent (U. S. Patent 6,793,910 B1). The applicants appear to be arguing limitations directed to a process, rather than the apparatus.

It is noted that the applicants have not amended their claims in their response under 37CFR1.116 filed on May 9, 2006.

All claims are drawn to the same invention claimed in the application prior to the entry of the submission under 37 CFR 1.114 and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the

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application prior to entry under 37 CFR 1.114. Accordingly, **THIS ACTION IS MADE FINAL** even though it is a first action after the filing of a request for continued examination and the submission under 37 CFR 1.114. See MPEP § 706.07(b).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Timothy C. Vanoy whose telephone number is 571-272-8158. The examiner can normally be reached on Mon-Fri 8-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman, can be reached on 571-272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Timothy C Vanoy
Timothy C Vanoy
Primary Examiner
Art Unit 1754

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